Drawings and Specifications Contest Activity Details

Teams are required to submit drawings and specifications on four separate occasions. Ideally, the drawings and specifications are continual works-in-progress that culminate in the as-built submittal, which is one of the final contract deliverables due after the Competition. The Organizers use the drawings and specifications for many purposes throughout the Project. The following is a brief description of each of the four required sets of drawings and specifications.

1. **Design Development Drawings and Specifications (due June 13, 2006)**: The following description of the design development project stage is taken directly from *The Architect's Handbook of Professional Practice: Student Edition*:

   > "Decisions made in schematic design are worked out at a more detailed level to minimize the possibility of major modifications being needed during the development of construction contract documents. In design development the design team works out a clear, coordinated description of all aspects of the design, including architectural, mechanical, electrical, plumbing, and fire protection systems. Deliverables are similar to those of schematic design but are more detailed. They include drawings and specifications, an updated cost estimate, and, if required, the preparation of estimated schedules for construction. Again, written client approval provides a basis for subsequent work. The approved design development documents provide the basis for the construction documents increment, which sets forth in detail the requirements for construction."

   The Organizers will evaluate the design development set to determine whether a team will receive conditional approval (analogous to the statement above, "written client approval provides a basis for subsequent work"). The Organizers will thoroughly review the information contained in this set and identify any deficiencies and requirements for final approval.

2. **Construction Drawings and Specifications (due March 6, 2007)**: The following description of the construction documents project phase is taken directly from *The Architect's Handbook of Professional Practice: Student Edition*:

   > "Once a design has been developed and approved, the architect prepares the drawings and specifications that set forth the requirements for construction. The development of the construction documents is an extension of the design process. Decisions on details, materials, products, and finishes all serve to reinforce the design concept—and begin the process of translating the concept into reality.

> The drawings show, in graphic and quantitative form, the extent, configuration, location, relationships, and dimensions of the work to be done. They generally contain site and building plans, elevations, sections, details, diagrams, and schedules. In addition to drawn information, they may include photographs, other imported graphics, and printed schedules. Architectural, structural, mechanical, electrical, civil, landscape, interior design, and other applicable specialty drawings should be included.
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> The specifications outline the levels of quality and the standards to be met in the construction process. Addenda include additional information that is not covered by drawings or specifications. The set of construction documents should communicate to the contractor the quantities, qualities, and configuration of the elements required to construct a project."

The construction set should address the deficiencies and requirements identified by the Organizers in the design development set review. If the construction drawings and specifications are satisfactory, a team will receive final approval. If significant deficiencies remain, updated construction drawings and specifications (see #3 below) must be sent to and reviewed by the Organizers before final approval can be granted. Teams that do not receive final approval may be asked to withdraw from the Competition.

3. **Updated Construction Drawings and Specifications (due August 7, 2007)**: This deliverable is mandatory only if a team did not receive final approval based on the Organizers' review of the original (March 6th) construction drawings and specifications. Otherwise, this deliverable is optional. However, teams that make significant design changes after March 6th are strongly encouraged to submit updated construction drawings and specifications to avoid potential problems during building inspections on the Mall. Teams that want to improve on their original construction drawings and specifications may also choose to submit an updated version for contest purposes. The Architecture Jury will evaluate and score one and only one set of drawings and specifications. If mandatory or optional updated construction drawings and specifications are not submitted, the Jury will evaluate the original construction drawings and specifications.

4. **As-Built Drawings and Specifications (due January 9, 2008)**: The following is a description of as-built drawings and specifications from H-K Resources Pte Ltd.

> "As-Built Drawings depict the final installed configuration (whether physical or functional). They indicate any construction deviations and show all features of the project as actually built. These drawings provide a permanent record of as-built conditions and aid as key references for future maintenance processes."

Because it is due after the Competition, the as-built set will obviously not count toward a team's score. However, the as-built set is a very important contract deliverable and shall reflect the final installed configuration of the house on its permanent site.

Minimum Content Requirements

No definition of the specific required content of construction documents exists. The following minimum content requirements are a guide to assist in organizing work effort. Additional content may be required or desired depending upon the requirements of specific designs.

Creativity applies to preparation of construction documents as much as to aesthetic decisions about designs. Effective modern construction documents tell a thorough story that allows the builder of the project to understand the design. Modern designers have excellent tools that allow communication of construction details in three dimensions augmenting ease of use of the construction documents. Teams are encouraged to explore three dimensional communication, photography, color and texture, as well as traditional plans, elevations, sections, and details in their construction documents presentations.

The **drawings** must include the following:

- *Table of Contents:* (This table should appear on the first page after Cover Sheet)
- *Site Plan and Elevations*: Show the placement of the house and exterior tour route within the Solar Envelope and show the locations of the car, water tanks, walkways, signs, vegetation, and all other site features. Elevations (or dimensioned 3-D views) are required for verification of compliance with the 18-ft. height rule.
- *Footprint and Conditioned Area Plan*: Clearly show estimated areas (using a program such as Brava Reader) for compliance with Event Regulation 11.3: House Sizing.
- *Architectural*: Include plans, elevations, and sections.
- *Structural*: Drawings shall be stamped by a Professional Engineer (PE) and demonstrate compliance with structural requirements in the Solar Decathlon Building Code.
- *Electrical*: Include sufficient detail to size and locate major components with the associated routing of conduit and duct systems for electrical power service and distribution, PV systems, lighting, data communication, lightning protection, ground fault protection, and data acquisition and control systems. Includes one-line diagrams. Demonstrate compliance with electrical requirements in the Solar Decathlon Building Code.
- *Mechanical and Plumbing*: Include sufficient detail to size and locate major components with the associated routing of piping, ducts, and plenums for plumbing, HVAC, and hot water heating systems. Demonstrate compliance with mechanical and plumbing requirements in the Solar Decathlon Building Code.
- *Accessibility*: Demonstrate compliance with the accessibility requirements in the Solar Decathlon Building Code. Show interior tour route.
- *Layouts*: Must contain sufficient detail to identify the layout of spaces, systems, furniture, and equipment, including material selections with colors, textures, finishes, etc.
- *System Schematics*: Include schematics of solar electric, hot water heating, and other unique or unusual systems.

- *Assembly Process*: Illustrates the assembly process, specifies the equipment to be used on site to aid the assembly process (e.g., cranes, forklifts), and estimates the time necessary to deliver and assemble the house.
- *Disassembly Process*: Illustrates the disassembly process, specifies the equipment to be used on site to aid the disassembly process (e.g., cranes and forklifts), and estimates the time necessary to disassemble and remove the house from the Mall.
- Other important drawings not included in this list.

The **specifications** must include the following:

- Table of Contents: Even equipment specification sheets shall have page numbers and be included in the table of contents.
- Summary of changes: If there are changes to the drawings and specifications between the design development set and the construction set, provide a summary of those changes with the construction set. If there are changes to the drawings and specifications between the original construction set and the updated construction set, provide a summary of those changes with the updated construction set.
- Structural calculations: These shall be stamped by a P.E.
- Solar cell specifications:
    - Copy of manufacturer's solar cell and module specification sheet(s)
    - Manufacturer's name and contact information
    - Stock number, type, or description
    - Manufacturer's quote for cell or module area
    - Manufacturer's quote for performance
    - Cost (US$) per watt for each cell or module.
- Battery specifications:
    - Copy of manufacturer's battery specification sheet(s)
    - Material Safety Data Sheets (MSDS) obtained from the manufacturer
    - Manufacturer's name and contact information
    - Stock number, type, or description
    - Module voltage (e.g., 6 V, 12 V, or 24 V)
    - Bus voltage
    - Number of modules to be used in the house
    - Manufacturer's specifications, including capacity (kWh), weight (lb.), and cost (US$)
    - Spill and damage protocols and procedures (if these are not provided in the MSDS, the team must obtain this information from the manufacturer and submit it with the MSDS).
- Information that is not included in the drawings, but is necessary to demonstrate compliance with the Solar Decathlon Building Code: For example, such information would include calculations showing that the battery enclosure ventilation is sufficient to maintain compliant hydrogen concentrations.

- Summary of unlisted electrical components and justifications for choosing unlisted components. Unlisted electrical components will be approved for use in the competition on a case-by-case basis.
- Manufacturers' data sheets for all major house components: These data sheets shall include, but not be limited to, kitchen appliances, hot water heating system components, water supply system components, solar electric balance of system components, HVAC system components, thermal storage devices and tanks, primary structural components, insulation, windows, and unusual finishes, fixtures, and furnishings.
- Material Safety Data Sheets (MSDS) required for all materials to be used at the Event that require an MSDS: These would include, for example, MSDS for cleaning solvents, glycol, rubber cement, rubbing alcohol, etc.
- Categorized inventory of water requirements: The Organizers need to know how much water is required to meet all the houses' needs during the Event.
- Any other important supplemental information not included in this list.

Note: Some information listed under the specifications requirements may be more appropriately located in the drawings as notes or tables. It is up to the teams to decide whether information belongs in the drawings or specifications. The Architecture Jury will evaluate how well the teams organize the information in the drawings and specifications.

Format Requirements

- Drawings must be 11 in. X 17 in. (or closest metric equivalent).
- Specifications must be 8.5 in. X 11 in. (or closest metric equivalent).
- There are no page number limits. The Architecture Jury will determine whether an appropriate amount of information has been conveyed in the drawings and specifications.
- Spiral bindings are required for both the drawings and specifications. Do not separate either the drawings or specifications into multiple "parts." One complete set of drawings and specifications consists of one and only one spiral-bound set of drawings and one and only one spiral-bound set of specifications.
- Five (5) hard copies of the design development drawings and specifications, eight (8) hard copies of the construction (original and updated) drawings and specifications, and three (3) copies of the as-built drawings and specifications are required. In addition to the hard copies, electronic files of the drawings and specifications are also required. The electronic files must meet the following requirements. If they do not meet these requirements, they will not be used in any brochures, signs, programs, or other promotional materials:
    - Images must be 11 in. X 17 in. (or closest metric equivalent) at 300 dpi.
    - TIFF files are preferable, but EPS or Adobe Illustrator (Version 5.5 or higher) files are also acceptable. AutoCAD or similar files will not be accepted.

    - Mac platform files are preferable, but PC platform files are also acceptable. Although problems with PC platform files are rare, they do sometimes occur, so if you want to make sure the Organizers can access your files, you should consider Mac platform files.
    - Files must be in RGB, 8-bit color.
    - Only compressed files using Stuffit or ZIP software will be accepted.
- A standard architectural title block must appear on the right side of every page of the drawing set. The title block may be toward the top, middle, or bottom of the page, but it must be placed on the right side.
- The scale of all plans (except Site Plan), elevations (except Site Elevations), and sections must be 0.25 in. = 1 ft-0 in. (or closest metric equivalent). However, a graphic scale must be used so that the drawing can be reduced or enlarged without consequence. The Site Plan and Site Elevations must be 0.125 in. = 1 ft-0 in (or closest metric equivalent).
- Construction details should be at an appropriate scale.
- There must be a 0.5 in. (or closest metric equivalent) margin around the entire page.
- Refer to *The Architect's Handbook of Professional Practice: Student Edition* for suggested drawing conventions regarding page numbers, text heights, layers, dimensions, symbols, specifications, etc.
- The cover sheet of the drawings set, to be used as quick reference by the Architecture Jury and the Dwelling Panel in their evaluations, must contain the following information:
    - Title
    - Floor plan
    - Site plan, i.e., location relative to other houses
    - Image of house exterior (can be a photo or computer rendering)
    - 250-word mission statement.
- Send the Drawings and Specifications package to the following address:

  Mike Wassmer
  National Renewable Energy Laboratory
  Mail Stop 3214
  1617 Cole Blvd.
  Golden, CO 80401
- To be considered on time, the package must arrive at NREL by 5 p.m. Mountain time on the due date. Points will be deducted for lateness.